WEST Search History

Hide Items | Restore | Clear | Cancel

DATE: Thursday, September 23, 2004

Hide?	Set Name	Query	Hit Count
		DB=DWPI; PLUR=YES; OP=ADJ	
☐	L9	de4414077	0
☐	L8	4414077	3
		DB=USPT; PLUR=YES; OP=ADJ	
☐	L7	US-6352084-B1.did.	1
☐	L6	US-6352084-B1.did.	1
		DB=DWPI; PLUR=YES; OP=ADJ	
☐	L5	19644253	1
		DB=USPT; PLUR=YES; OP=ADJ	
☐	L4	US-5902402-A.did.	1
☐	L3	US-5902402-A.did.	1
		DB=DWPI; PLUR=YES; OP=ADJ	
☐	L2	19546990	1
		DB=USPT; PLUR=YES; OP=ADJ	
☐	L1	4804007.pn.	1

END OF SEARCH HISTORY

WEST Search History

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DATE: Thursday, September 23, 2004

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☐	L21	5569330.pn.	1
☐	L20	5275184.pn.	1
☐	L19	L18 and fluid	23
☐	L18	L17 and (quartz or steel)	36
☐	L17	L12 and (wall) and substrates	50
☐	L16	L12 and (steel same wall) and substrates	1
☐	L15	L12 and (steel same wall) not l13 not l14	3
☐	L14	L12 and (quartz same wall) not l13	12
☐	L13	L12 and (quartz same steel)	18
☐	L12	steag.as.	155
☐	L11	'mhz bars'	7
☐	L10	oshinowo.in.	8
		DB=DWPI; PLUR=YES; OP=ADJ	
☐	L9	de4414077	0
☐	L8	4414077	3
		DB=USPT; PLUR=YES; OP=ADJ	
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☐	L6	US-6352084-B1.did.	1
		DB=DWPI; PLUR=YES; OP=ADJ	
☐	L5	19644253	1
		DB=USPT; PLUR=YES; OP=ADJ	
☐	L4	US-5902402-A.did.	1
☐	L3	US-5902402-A.did.	1
		DB=DWPI; PLUR=YES; OP=ADJ	
☐	L2	19546990	1
		DB=USPT; PLUR=YES; OP=ADJ	
☐	L1	4804007.pn.	1

END OF SEARCH HISTORY

WEST Search History

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DATE: Thursday, September 23, 2004

Hide?	Set Name	Query	Hit Count
		DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ	
☐	L10	L9 and mrayl	5
☐	L9	acoustical impedance and (nickel or chromium)	115
		DB=USPT; PLUR=YES; OP=ADJ	
☐	L8	L6 and nickel	3
☐	L7	L6 and chromium	0
☐	L6	acoustical impedance and mrayl	12
☐	L5	chromium and mrayl	8
☐	L4	chromium same mrayl	0
☐	L3	chromium same 'acoustical impedance'	1
☐	L2	L1 same 'acoustical impedance'	1
☐	L1	impedance same chromium	170

END OF SEARCH HISTORY

WEST Search History

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DATE: Thursday, September 23, 2004

Hide?	Set Name	Query	Hit Count
		DB=USPT; PLUR=YES; OP=ADJ	
☐	L4	l2 and mrayl	6
☐	L3	L1 same chromium	17
☐	L2	L1 and chromium	211
☐	L1	acoustic impedance	4339

END OF SEARCH HISTORY

propagated through the encapsulation from the crystal 43, and preferably, in order to maintain reasonable dimensional tolerances, the thickness of the encapsulation layer should be three one-quarter wavelengths of the operating frequency of the acoustic energy propagating through the encapsulation layer.

The encapsulation layer, in addition to having the indicated odd number of one-quarter wavelengths in thickness, must also have an acoustical impedance less than the acoustical impedance of water, in order to optimize the electrical characteristic of the transducer and the acoustic response at the preferred operating frequency. The acoustical impedance of water is 1.5 MRayls. It has been found satisfactory to form the encapsulation layer 46 of a silicone elastomer known as Sylgard 184 manufactured and sold by Dow Corning Corporation, Midland, Mich., and comprised of a two-part kit consisting of liquid components to be mixed together. The silicone elastomer, Sylgard 184 has an acoustical impedance of approximately 1.0 MRayls at room temperature, which is less than the acoustic impedance of water, i.e., 1.5 MRayls. The thickness at three one-quarter wavelengths of the operating frequency propagated through the encapsulation layer equals 0.035 inch (0.089 centimeter) at the operating frequency of approximately 850 KHz. The combination of characteristics of the encapsulation layer are critical. It must be an electrically insulating material, it must have an acoustical impedance less than the acoustical impedance of water, and the encapsulation layer must have a thickness comprising an odd number, preferably three, of one-quarter wavelengths of the operating frequency in the encapsulation layer. Other silicone elastomers with acoustical impedance in the range of 0.9 to 1.4 MRayls may also be used, but those at the lower end of the range are preferred. In the event that the liquid solution 12, in which the substrates are immersed, varies significantly from pure DI water as to significantly change the acoustical impedance of the liquid solution 12, then the choice of material in the encapsulation layer 46 must change so that the acoustical impedance of the encapulsation layer is less than the acoustical impedance of the liquid solution 12, as used.

The acoustical impedances of various types of common materials is published information shown in the following Table I wherein some of the values are estimates based on the range of impedances given for similar materials.

TABLE I

TYPICAL ACOUSTICAL IMPEDANCES OF COMMON MATERIALS (IN MRayls)	
AIR	.0004
ALCOHOL	.9
GASOLINE	1.0
TURPENTINE	1.1
GLYCOL	1.7
WATER	1.5
ALUMINUM	17.3
POLYURETHANE	1.8
PLASTIC	2.4
EPOXY	3.5
SILICONE RTV	1.4
OILS	1.3
QUARTZ	13.1
GLASS	13.0
TANTALUM	54.8
STAINLESS STEEL	45.7
SILVER	38.0

One specific material, i.e. Sylgard 184, which has been found satisfactory is one of a multiplicity of room temperature vulcanizing (RTV) materials. Other suitable materials for use in the encapsulation layer and having an acoustical impedance (in MRayls) are defined as follows:

TABLE II

Product Identification	Acoustical Impedance MRayls
MATERIALS FROM DOW CORNING:	
Sylgard 178 (a silicon rubber)	1.34
Sylgard 182	1.07
Sylgard 186	1.15
Dow Silastic Rubber GP45 (45 Durometer)	1.16
Dow Silastic Rubber GP 70 (70 Durometer)	1.30
OTHER RTV MATERIALS FROM GENERAL ELECTRIC:	
RTV-11	1.24
RTV-21	1.32
RTV-30	1.41
RTV-41	1.32
RTV-60	1.41
RTV-602	1.18
RTV-616	1.29
RTV-630	1.30

In forming the encapsulation layer 46 onto the faces of the piezo crystals 43, a thin layer Dow Corning Sylgard Prime Coat, i.e., a dilute moisture-reactive solution in heptane solvent, is applied to the faces of the piezo crystals 43 in order to promote bonding between the piezo crystals and the encapsulation layer 46. The prime coat layer is so thin so that it has no appreciable effect on the acoustical output of the transducer.

In forming the encapsulation layer 46 onto the front faces of the piezo crystals 43, it is important to remove all of the air which may exist in the two-part silicone material which is used to make up the encapsulation layer. The two parts of the elastomer are measured and mixed together according to the manufacturer's recommended ratio and are placed under a vacuum of 25 to 29 inches of mercury to remove all air bubbles trapped within the mixture. All of the air must be removed because acoustic energy cannot pass through the air, and the bubbles may make holes in the protective encapsulation layer, and the holes could become passages for the coupling water to short out the crystals or otherwise form hot spots when the acoustical energy is propagated through the encapsulation layer. After the elastomer mixture of the encapsulation layer 46 is formed, the mixture is then injected into a cavity formed by a mold plate in front of the crystals 43, and allowing the air to escape as the encapsulation layer is formed. The encapsulation layer, when completely cured, must have the desired thickness in a uniform layer over the front faces of the crystals.

In order to eliminate a maximum of air in the acoustic energy transmitting means 38A, i.e., the encapsulation layer 46 and the liquid coupling layer 38, the surface 46A of the encapsulation layer 46 which impinges the liquid coupling layer 38 is treated to be hydrophilic as to be entirely wettable. Without treatment, the surface 46A of the encapsulation layer may be hydrophobic, which allows air bubbles to stick to the surface. Treatment of the surface to be hydrophilic may be accomplished in a number of processes, but one successful treatment has been to place the entire crystal array, with the encapsulation layer 46 already existing on the piezo crystals, into a cleaning oven containing an

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Velocity Table

Acoustical Properties Of Common Materials					
Material	Ultrasonic Velocity				
	Longitudinal		Transverse (Shear)		Impedance
	in / us	mm / us	in / us	mm / us	Z
METALS					
Aluminum 1100-0	0.248	6.229	0.121	3.073	17.1
Aluminum 2024-T4	0.251	6.375	0.124	3.150	17.6
Aluminum 6061-T6	0.248	6.299	0.124	3.150	17.0
Beryllium	0.507	12.878	0.350	8.890	23.5
Brass (70% Cu - 30% Zn	0.172	4.369	0.083	2.108	37.1
Bronze (Phosphor 5%)	0.139	3.531	0.088	2.235	31.3
Copper (CP)	0.187	4.750	0.092	2.337	42.5
Gold	0.128	3.251	0.047	1.194	62.6
Hastelloy C	0.230	5.842	0.114	2.896	52.2
Hastelloy X	0.228	5.791	0.108	2.743	47.7
Inconel (Wrought)	0.308	7.823	0.119	3.023	64.5
Iron (Cast), Various Alloys	0.138-0.220	3.505-5.588	0.087-0.126	2.210-3.200	24.3-41.2
Lead (94Pb-6Sb)	0.085	2.159	0.032	0.813	23.5
Magnesium, Various Alloys	0.215-0.228	5.461-5.791	0.119-0.122	3.023-3.099	9.24-10.6
Monel	0.211	5.359	0.107	2.718	47.2
Nickel (CP)	0.222	5.639	0.117	2.972	50.0
Silver (0.99 Fine)	0.142	3.607	0.063	1.600	37.8
Steel 1020	0.232	5.893	0.128	3.251	45.4
Steel 4340	0.230	5.842	0.128	3.251	45.6
Steel , CRES 300 Series	0.221-0.226	5.613-5.740	0.120-.0123	3.048-3.124	44.6-45.4
Steel , CRES 400 Series	0.212-0.237	5.385-6.020	0.118-0.132	2.997-3.353	41.3-46.3
Titanium, 6Al-4V	0.243	6.172	0.130	3.302	27.3
Zircaloy	0.186	4.724	0.093	2.362	44.2
Zirconium	0.183	4.648	0.089	2.261	30.1
POLYMERS					
Acrylics	0.105-0.109	2.667-2.769	0.044-0.057	1.118-1.448	3.15-3.51
Cellulose Acetate	0.096	2.438	No Shear Component		3.19
Nylon	0.016	2.692	No Shear Component		------------
Phenolic	0.056	1.422	No Shear Component		1.90

Polycarbonate	0.090	2.286	No Shear Component		2.71
Polyethylene	0.105	2.667	No Shear Component		2.94
Polystyrene	0.094	2.388	0.045	1.143	2.52
Rubber (Natural)	0.061	1.549	No Shear Component		1.74
Rubber (Carbon Filter)	0.066	1.676	No Shear Component		-------------
Rubber (Silicone)	0.037	0.94	No Shear Component		1.40
Teflon	0.054	1.372	0.250	6.35	3.00
MISCELLANEOUS SOLIDS					
Alumina (Al2O3)	0.427	10.846	No Shear Component		43.1
Concrete	0.167-0.207	4.242-5.258	0.135	3.429	12.4
Glass (Plate)	0.227	5.766	No Shear Component		14.5
Granite	0.156	3.962	0.076	1.93	10.9
Ice (-16C)	0.150	3.81	No Shear Component		3.60
Quartz, Natural	0.226	5.74	0.139	3.531	15.2
Quartz, Fused	0.219	5.563	0.302	7.671	14.5
Sapphire	0.469	11.913	0.157	3.988	47.2
Tungsten Carbide	0.262	6.655	No Shear Component		67.6
COMPOSITE MATERIALS					
Fiberglass (50 v/o)	0.124	3.15	0.068	1.727	6.04
Graphite/Epoxy (60 v/o)	0.117	2.972	0.077	1.956	4.65
Boron/Epoxy (50v/o)	0.131	3.327	0.072	1.829	6.38
LIQUIDS					
Ethylene Glycol	0.064	1.626	No Shear Component		1.80
Glycerin	0.076	1.93	No Shear Component		2.42
Oil (SAE 20)	0.069	1.753	No Shear Component		1.51
Water (20C)	0.058	1.473	No Shear Component		1.48
Gases					
Air (20°C)	0.014	0.356	No Shear Component		0.00041
Nitrogen (20°C)	0.014	0.356	No Shear Component		0.00041
Oxygen (20°C)	0.013	0.33	No Shear Component		0.00043

NDT Systems, Inc.
17811 Georgetown Lane, Huntington Beach, CA. 92647
Phone (714) -893-2438 * Fax (714) -897-3840
Contact info@ndtsystems.com with questions or comments on N
Contact webmaster@ndtsystems.com with questions or commen

ELECTRON BEAM SOURCES

Certain materials (for example titanium, nickel, cobalt, semi-refractory metal oxides and rare earth oxides) are difficult to evaporate with resistance heated sources, but can be readily deposited when heated by electron bombardment.

Electron beam sources provide economical and efficient usage of evaporant, enable easy changeover between evaporants and achieve high deposition rates. The high degree of control possible with electron beam sources enables constant rate deposition.

BOC Edwards manufactures a range of compact electron beam sources for the thin film researcher. All are supplied in modular form with all the parts to enable easy installation into BOC Edwards coating systems.

EB1 MAGNETICALLY FOCUSED ELECTRON BEAM SOURCE

An ultra-compact electron beam source supplied mounted on an integral dual water feedthrough. The 1 cm^3 copper hearth enables high rate, thick film depositions. Multiple sources can be fitted for multi-layer depositions.

The standard hearth is a water-cooled copper block with a conically shaped aperture to accept a removable copper crucible. Refractory crucible liners can be fitted for evaporating such materials as aluminium and copper.

The power rating of the EB1 source is variable up to 3.0 kVA. Beam deflection of 180° is achieved by a permanent magnet manufactured from Trigonal G, specially selected for its low outgassing characteristics and field stability at high temperatures.

The EB1 source is powered by the EB3 5 kV 600 mA constant voltage power supply.

The source is supplied complete with two high vacuum feedthroughs and an installation kit.

TECHNICAL DATA

Maximum power rating	3 KVA
HT voltage	4.5 - 5.5 kV
Emission current	600 mA maximum
Crucible	1 cm^3 copper
Beam spot size	3 mm
Minimum cooling water flow	3 l min^{-1} at 20 °C
Minimum vacuum	1 x 10^{-4} mbar
Weight	1.4 kg

PRODUCT DESCRIPTION	ORDERING NUMBER
EB1 Electron beam source (1 cm^3)	E090-46-000

The EB1 uses the same power supply as the EB3: refer to the EB3 information for ordering details.

SPARES	ORDERING NUMBER
Spare filament EB1/EB3	E036-15-005

EB3 3kW power supply with gun controls, X-Y sweep controller and turret indexer controls mounted in the 19 inch rack adaptor.

ACCESSORIES	ORDERING NUMBER
Water flow switch kit	E090-81-000
Intermetallic hearth liner	E036-15-017
Carbon hearth liner	E036-15-021
Copper crucible	E036-15-018

EB3 MULTI HEARTH ELECTRON BEAM SOURCE

Multi hearth source

The EB3 series of sources provides all the features normally only found in much larger production systems in a compact size. The small footprint of the EB3 maximises space in the vacuum chamber for other process hardware and also enables the source to be positioned where required for optimum coating uniformity.

- Four 4 cm^3 crucibles, with 30 cm^3 hopper and flat disc crucible options
- 270° electron beam deflection minimises filament contamination and prolongs filament life
- Removable water-cooled crucibles for easy cleaning and economical replacement
- 'Plug-in' emitter assembly for convenient filament maintenance
- Integral X-Y beam sweep coils enable optimum beam control during evaporation
- Inactive crucibles shielded to prevent cross-contamination of evaporation materials

EB3 3kW electron beam power supply

A rugged 3kW constant voltage power supply comprising a free-standing power module and a console mounting control unit.

Installation accessories

Modular kits are available to enable the EB3 electron beam source to be easily installed in BOC Edwards and other makes of coating system. Kits include leadthroughs, turret drive mechanisms, mounting hardware and all necessary pipes, cables and mechanical parts.

TECHNICAL DATA

Maximum power rating	3 kVA
HT voltage	4.5 - 5.5 kV
Filament supply	6 V at 20 A
Maximum filament current	600 mA
Magnet (permanent)	Alnico
Crucible	4 cm^3 (x4) or 30 cm^3 (x1)
Beam spot size	4 mm
Minimum cooling water	3 l min^{-1} at 20 °C
Minimum vacuum	1 x 10^{-4} mbar
Weight	4.9 kg

PRODUCT DESCRIPTION	ORDERING NUMBER
EB3 Multihearth electron beam source (4 x 4cm^3	E090-72-00(
EB3 3kW power supply	
380/415/440V, 50Hz	E090-60-00(
220V, 60Hz	E090-61-00(
ACCESSORIES	**ORDERING NUMBER**
EB3 Vacuum feedthrough kit	E090-80-00(
EB3 Water flow switch kit	E090-81-00(
EB3 Beam sweep unit	E090-82-00(
EB3 Motorised turret drive kits	E090-83-00(
EB3 Manual turret drive kit	E090-84-00(
EB3/FL400 Mounting kit	E090-93-00(
19 inch rack adaptor for EB3 controls	D354-22-00(
EB3 Single hearth crucible kit (30cm^3	E090-87-02:
EB3 Disc crucible kit	E090-87-02:
Graphite liner for 30cm^3 crucible	E090-88-02(
Molybdenum liner for 30cm^3 crucible	E090-88-021
Intermetallic liner for 30cm^3 crucible	E090-88-02:
Graphite liner for 4cm^3 crucible	E090-88-03(
Molybdenum liner for 4cm^3 crucible	E090-88-031
Intermetallic liner for 4cm^3 crucible	E090-88-03:

- 5 kV, 600 mA output with twin tetrode power tubes for ± 1% voltage regulation and instantaneous arc recovery
- Power module and gun control modules can be mounted in 19 inch electrical cabinets
- Comprehensive interlock system to ensure operator safety and prevent incorrect operation
- Compatible with most quartz crystal deposition controllers enabling fully automatic, constant rate deposition

X-Y beam sweep unit

Provides the facility to scan the electron beam in the lateral and longitudinal directions with full control of beam start position, sweep amplitude and oscillation frequency. The various sweep patterns that can be generated enable rapid and uniform heating of large evaporant volumes and materials with poor thermal conductivity.

FILM THICKNESS MONITORS

BOC Edwards manufacture a range of quartz crystal film thickness monitors with a range of features to suit different customer applications and budgets.

FEATURES COMPARISON

	FTM6	FTM7
Deposition rate display		
Number of materials in memory	2	11
Acoustic impedance correction		
Tooling factor correction		
Number of shutters controlled	1	2
Self-test facility		
Crystal usage indication		
Chart recorder output		
Quartz crystal inputs	1	2
RS232 interface		
Multi-layer auto-sequence mode		

FTM6 DIGITAL FILM THICKNESS MONITOR

- Easy to read LED display of film thickness
- Memory storage for 2 deposition materials
- Automatic shutter control for reproducible film thickness termination
- Compact, space saving design

The FTM6 is an inexpensive film thickness monitor with high resolution and advanced features including shutter control for precise film thickness termination.

The compact size of the FTM6 makes it particularly suitable for use with small coating systems.

The FTM6 can be used as a free-standing instrument or mounted into control consoles using the panel mounting kit supplied.

Display	
Thickness display	0.0 nm - 999.9 αm
Resolution	0.1 nm
Display update rate	1 Hz
Material parameters	
Layers	1 or 2
Density	0.1 - 99.9 g cm $^{-3}$

Thickness termination	0.0 nm - 999.9 ∝m
Tooling factor	0.01 - 99.9%
Sensor crystal operating range	5.1 - 6.1 MHz
Shutter relay rating	220 V dc, 2 A or 250 V ac, 2A
Electrical supply voltage [1] 50/60 Hz	110 V - 220 V - 240 V (±10 %)
Electrical supply current	9 W
Dimensions	110 mm wide, 105 mm high, 185 mm deep
Weight	1.6 kg

1 Selectable

For further information, request publication E086-30-895.

An oscillator and crystal holder are required with each FTM6 film thickness monito

PRODUCT DESCRIPTION	ORDERING NUMBER
FTM6 film thickness monitor	E086-64-000

FTM7 DIGITAL FILM THICKNESS MONITOR

UNIVERSAL CRYSTAL HOLDER

The BOC Edwards crystal holder is suitable for most deposition processes and it operates effectively in an RF sputtering environment.

Good thermal stability is achieved by water cooling the crystal holder, which can also be baked up to 200 °C. The flexible water lines can be extended to allow easy positioning of the crystal head. The snap-in crystal enclosure makes crystal changing easy and quick.

The crystal holder has a standard NW25 leadthrough, and is ready for immediate installation without soldering, brazing or separate water connections.

PRODUCT DESCRIPTION	ORDERING NUMBER
Oscillator, 3 m cable	E086-66-00(
Crystal holder, includes pack of 5 crystals	E086-67-00(
Spare crystals (pack of 5)	E086-68-00(

- Easy to read LED display of film thickness and deposition rate
- Memory storage for 11 deposition materials
- Dual crystal holder/dual shutter control facility
- Tooling factor and **acoustic impedance** error correction
- Auto-sequence mode for simplified multi-layer deposition
- RS232 interface

The FTM7 is a sophisticated, fully featured instrument for monitoring film thickness and deposition rate.

Up to 2 quartz crystal sensors can be connected to the FTM7, enabling two deposition sources to be sequentially monitored by separate sensors.

Built-in relays can be used to control up to two separate source shutters allowing deposition from two sources to be precisely terminated. A unique feature is the auto-sequence mode which simplifies multi-layer deposition by automatically selecting the next deposition material each time the Run button is selected.

The RS232 interface allows the FTM7 to be programmed by an external computer and can also output data during the deposition process.

Display

Thickness display	0.0 nm - 999.9 ∝m
Rate display	0.0 - 999.9 n ms^{-1}

Resolution	0.1 nm
Display update rate (variable)	1 - 4 Hz
Material parameters	
Layers	1 - 11
Density	0.1 - 99.9 g cm $^{-3}$
Thickness termination	0.1 nm - 999.99 ∝m
Film acoustic impedance	1 - 99.9 x 10 ^{5} g cm $^{-2}$ s $^{-1}$
Tooling factor	0.01 - 99.9 %
Sensor crystal operating range	5.1 - 6.1 MHz
Shutter relay rating	220 V dc, 2 A or 250 V ac, 2 A
Analogue output	
Impedance	0 to 1 V, 1 k Ohm
Resolution	8 bit
Electrical supply voltage [1] 50/ 60 Hz	100 - 120 V 220 - 240 V (±10 %)
Electrical supply current	50 W
Dimensions	192 mm wide, 96 mm high, 243 mm deep
Weight	2.9 kg

1 Selectable

At least one oscillator and crystal holder are required with each FTM7.

PRODUCT DESCRIPTION	ORDERING NUMBER
FTM7 film thickness monitor	E086-69-000

EPM75 AND EPM100 PLANAR MAGNETRON SPUTTERING SOURCES

TECHNICAL DATA

Services	
Cooling water flowrate	75 l h $^{-1}$ 15 °C
Cooling water pressure	3 bar minimum
Inlet and outlet connections	8 mm od for rigid nylon tube
Output power connectors	N-type co-axial sockets
Recommended cable	
Type	PTFE insulated co-axial
Specification	RG213 or RG225
Vacuum leadthrough	25 mm (1 inch) hole
Target thickness	5 - 6.4 mm
Target diameter	
EPM75	75 - 77 mm
EPM100	100 - 102 mm
Target utilisation	
EPM75	31 %
EPM100	32 %
Target lifetime approximate	
EPM75	8 kWh
EPM100	20 kWh
Maximum power	
EPM75	1.5 kW dc, 1.0 kW rf
EPM100	3.0 kW dc, 1.5 kW rf
Overall diameter	
EPM75	107 mm
EPM100	141 mm
Maximum baseplate thickness	20 mm
Overall height, baseplate to target	
EPM75	123 mm
EPM100	127 mm
Overall height, baseplate to top of shield	
EPM75	139 mm
EPM100	140 mm

- Easy to install
- Integral NW25 leadthrough
- RF or DC operation
- Magnetron or diode sputtering
- Offset leadthrough enables variable radial positioning

BOC Edwards planar magnetron sputtering sources are easy to fit and position in any vacuum system that has suitable 25 mm or 1 inch diameter holes. The offset leadthrough design allows easy adjustment of the radial source position. The EPM source design is well proven, having been used for many years on BOC Edwards sputtering systems.

Simple installation

The interface/services box contains two power connection sockets and quick-fit water connections. Power connection can be made by suitable cable to either an rf power supply, via a matching network, or a dc power supply. Installation into a vacuum system is through a standard NW25 or 25.4 mm diameter hole. Positioning of the source relative to the workholder is critical to the performance of a sputtering system. The EPM series has easy radial adjustment. The vacuum feedthrough is offset, enabling the cathode's radial position to be adjusted by rotating the electrode body around the feedthrough.

DC or RF operation

The EPM series of sources is designed for either dc or rf operation for efficient sputtering of both insulators and conductors. Each cathode is supplied with electrode shielding to contain rf radiation and to provide safe installation. Diode operation is achieved by removing the magnets and the use of a suitable power supply.

Target mounting

A simple clamping ring secures the target to a water-cooled copper backing electrode enabling target materials to be quickly and easily changed between sputtering runs. EPM sources are designed to accept simple circular targets that are easy to manufacture and hence economical to produce. High strength rare earth magnets are used to focus the plasma and provide fast deposition rates and efficient target material usage.

Sputtering rate, aluminium 1	
30 mm from source to substrate	13.5 nm s^{-1}
60 mm from source to substrate	4.4 nm s^{-1}
80 mm from source to substrate	2.6 nm s^{-1}
100 mm from source to substrate	1.6 nm s^{-1}
Sputtering rate, copper 1	
30 mm from source to substrate	21.3 nm s^{-1}
60 mm from source to substrate	7.1 nm s^{-1}
80 mm from source to substrate	4.2 nm s^{-1}
100 mm from source to substrate	2.6 nm s^{-1}

1 EPM75 source, 5×10^{-3} mbar process pressure, 750 W rf sputtering power.

PRODUCT DESCRIPTION	ORDERING NUMBER
Magnetron sputtering source	
EPM75	E093-03-000
EPM100	E093-04-000

For further information, request publication number E093-10-895

MATERIAL	SYMBOL	DENSITY g cm^{-3}	ACOUSTIC IMPEDANCE (Zf)	MELTING POINT °C	RESISTANCE SOURCE	EB EVAPORATION EFFICIENCY	EB CRUCIBLE LINER	SPUTTER TYPE	APPROXIMATE RELATIVE SPUTTER RATE
Aluminium	Al	2.70	8.17	660	W, Ta	V.Good	IM	DC	1.0
Antimony	Sb	6.62	11.49	660	Mo, Ta	Poor	IM	DC	2.7
Beryllium oxide	BeO	3.01	-	2530	W	Good	-	RFr	
Boron	B	2.54	22.69	2100	Carbon	V.Good	C,VC	RF	
Cadmium	Cd	8.64	12.94	321	W, Mo	Poor	-	DC	
Cadmium sulphide	CdS	4.83	8.66	1750	W, Mo	Poor	C	RF	
Cadmium telluride	CdTe	5.85	9.00	1098	Mo	-	-	RF	
Calcium fluoride	CaF_2	3.18	11.39	1360	W, Mo	-	-	RF	
Carbon	C	2.25	2.71	3727	-	Good	-	DC	0.1
Cerium	Ce	6.78	-	795	W	Good	VC	DC	
Cerium (IV) Oxide	CeO_2	7.13	-	2150	W	Good	-	RFr	
Chromium	Cr	7.20	28.94	1890	W	Good	C	DC	1.1

Chromium (III) Oxide	Cr_2O_3	5.21	-	2435	W, Mo	Good	-	RFr	
Cobalt	Co	8.71	25.73	1495	W	V.Good	-	DC (m)	
Copper	Cu	8.93	20.20	1083	W, Mo	V.Good	C, Mo	DC	1.8
Gallium arsenide	GaAs	5.31	5.55	1238	W	Good	C	RF	
Germanium	Ge	5.35	17.10	937	W, Mo	V.Good	C	DC	1.0
Gold	Au	19.30	23.17	1062	W, Mo	V.Good	C	DC	2.3
Indium	In	7.30	10.49	157	W, Mo	V.Good	Mo	DC	0.5
Indium antimonide	InSb	5.76	10.98	535	W	-	-	RF	
Indium oxide	In_2O_3	7.18	-	c.2200	W	Poor	-	RF,RFr/DC	0.3
Iridium	Ir	22.40	68.40	2459	-	Poor	-	DC	
Iron	Fe	7.86	25.29	1535	W	V.Good	-	DC (m)	
Lead	Pb	11.30	7.81	328	W, Mo	V.Good	C	DC	2.5
Lead sulphide	PbS	7.50	15.59	1114	W	-	-	RF	
Lithium fluoride	LiF	2.64	11.40	870	W, Mo	Good	-	RF	
Magnesium	Mg	1.72	12.18	651	W, Mo	Good	C, VC	DC	
Magnesium fluoride	MgF_2	3.00	-	1266	Mo	V.Good	-	RF	
Magnesium oxide	MgO	3.58	21.47	2800	W	Good	C	RF, RFr	
Manganese	Mn	7.20	23.41	1244	W, Mo	Good	-	DC	1.8
Molybdenum	Mo	10.20	34.34	2610	-	V.Good	-	DC	0.8
Nickel	Ni	8.91	26.66	1453	W	V.Good	-	DC (m)	1.4
Niobium	Nb	8.57	17.90	2468	-	V.Good	-	DC	0.6
Palladium	Pd	12.00	24.72	1550	-	Poor	-	DC	1.9
Platinum	Pt	21.40	36.06	1769	W	V.Good	C	DC	1.3
Potassium chloride	KCl	1.98	4.30	776	-	-	-	RF	

MATERIAL	SYMBOL	DENSITY $g\,cm^{-3}$	ACOUSTIC IMPEDANCE (Zf)	MELTING POINT °C	RESISTANCE SOURCE	EB EVAPORATION EFFICIENCY	EB CRUCIBLE LINER	SPUTTER TYPE	APPROXIMATE RELATIVE SPUTTER RATE
Selenium	Se	4.82	10.21	217	W, Mo	Good	-	RF	
Silicon	Si	2.32	12.39	1410	W, Ta	V.Good	-	DC, RF	0.5
Silicon dioxide	SiO_2	2.20	8.25	1710	-	V.Good	-	RF	0.1
Silicon monoxide	SiO	2.13	10.15	1703	W, Ta, Mo	V.Good	-	RF	
Silver	Ag	10.50	16.68	961	W, Mo	V.Good	C	DC	2.9
Silver bromide	AgBr	6.47	7.48	432	Ta	Poor	-	RF	
Silver chloride	AgCl	5.56	6.68	455	Mo	Poor	-	RF	
Sodium chloride	NaCl	2.17	5.62	801	W, Mo	Poor	-	RF	

Tantalum	Ta	16.60	33.68	2996	-	V.Good	-	DC	0.5
Tellurium	Te	6.00	9.80	452	W, Ta	Poor	VC	RF	
Tin	Sn	7.30	12.19	232	W, Ta	V.Good	VC	DC	1.1
Tin oxide	SnO2	6.95	-	1127	W	V.Good	-	RFr/DC	
Titanium	Ti	4.50	14.05	1657	W, Ta	V.Good	C	DC	0.5
Titanium dioxide	TiO2	4.17	22.07	1640	W, Mo	Poor	-	RFr	
Titanium oxide	TiO	4.90	-	1750	W, Mo	Good	VC	RF	
Tungsten	W	19.30	54.14	3410	-	Good	-	DC	0.5
Tungsten carbide	WC	15.60	58.44	2860	-	V.Good	-	RF	
Vanadium	V	5.96	16.65	1890	Mo	V.Good	-	DC	0.6
Yttrium	Y	4.34	10.57	1509	W, Ta	V.Good	-	RF	
Zinc	Zn	7.04	17.17	419	W, Mo	V.Good	-	DC	
Zinc oxide	ZnO	5.61	15.87	1975	Mo	Poor	-	RF	
Zinc selenide	ZnSe	5.42	12.22	1526	Mo, Ta	-	-	RF	
Zinc sulphide	ZnS	4.09	11.39	1830	Mo, Ta	Good	-	RF	

W Tungsten
Mo Molybdenum
C Carbon
VC Vitreous carbon
IM Intermetallic
DC DC Magnetron Sputtering
RF RF Magnetron Sputtering
RFr Reactive RF Magnetron Sputtering
(m) Magnetic – may interfere with magnetron sputtering

SIZE	A	B	C	D	E	F	ORDERING NUMBER
TUNGSTEN FILAMENTS							
A1	19	4.8	1	0.5	15-20	10	H014-01-0(
A2	19	4.8	3	0.5	40	10	H014-01-0(
A4	25	6.5	3	0.5	40	10	H014-01-0(
A8	9.5	4.8	1	0.5	20	10	H014-01-0(
A10	44.5	9.5	3	0.5	40	25	H014-01-0(
A12	52.5	8.5	3	0.5	50	10	H014-01-0'

B1	14.5	2.4	1	0.5	15-20	10	H014-01-0:
B2	16	4.8	3	0.5	30-40	10	H014-01-0:
B6	19	13	2	1.0	50-60	10	H014-01-0:
B7	16	6.5	3	0.5	40	10	H014-01-0:
F1		22.3	3	0.5	30-40	10	H014-01-0:
F2		22.3	3	0.75	80-120	10	H014-01-0:

C - Number of strands; D - Wire diameter;
E - Evaporation current, amps; F - Number per pack

MOLYBDENUM BOATS

C1	19	4.8	6.5	0.05	25	10	H014-01-0‹
C3	31.8	9.5	11	0.1	80	10	H014-01-0‹
C4	25	13	14.5	0.1	100	10	H014-01-0‹
C5	25	13	16	0.1	100	10	H014-01-0‹
C2	51	9.5	9.5	0.05	45	10	H014-01-0‹

D - Thickness; E - Evaporation current, A; F - Number per pack

TUNGSTEN BOATS

C6	47.6	12.7	12.7	0.05	70	10	H014-01-0(

D - Thickness; E - Evaporation current, A; F - Number per pack

COVERED MOLYBDENUM BOATS

These boats are useful for materials that split when heated (such as silicon monoxide and cadmium sulphide). G2 is the cover for the boat G1.

G1	41.3	6.5	14.5	0.05	100	10	H014-01-0‹
G2	41.3	4.8	25	0.05	100	10	H014-01-0‹

D - Thickness; E - Evaporation current, A; F - Number per pack

To avoid damage to your coating system, match the evaporation source to the power supply, as shown here.

COATING SYSTEM	LT RATING
12E	10 V at 60 A, 30 V at 20 A
Auto 306,E12E, E306, E306A	10 V at 90 A, 30 V at 30 A
	5 V at 200 A, 3 V at 350 A
18E	20 V at 150 A
19E	20 V at 190 A, 10 V at 380 A